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Safety Design Requirements for Active Hazard Mitigation Device (AHMD) Employed to Address Fast and Slow Cook-off Thermal Threats

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14. ABSTRACT
This document establishes specific design safety criteria for Active Hazard Mitigation Device (AHMD) intended for use with munition systems for the purpose of reducing the severity of response from such systems when subjected to Insensitive Munitions (IM) thermal threat environments.

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DEPARTMENT OF DEFENSE

JOINT ORDNANCE TEST PROCEDURE (JOTP)-050

SAFETY DESIGN REQUIREMENTS FOR ACTIVE HAZARD MITIGATION DEVICE (AHMD) EMPLOYED TO ADDRESS FAST AND SLOW COOK-OFF THERMAL THREATS

DOD Fuze Engineering Standardization Working Group (FESWG)

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Joint Ordnance Test Procedure (JOTP)-050
Safety Design Requirements for Active Hazard Mitigation Device (AHMD) Employed to Address Fast and Slow Cook-off Thermal Threats

DOCUMENT COMPLETION DATE:	**TITLE AND SUBTITLE:**
18 December 2014	Joint Ordnance Test Procedure (JOTP)-050 Safety Design Requirements for Active Hazard Mitigation Device (AHMD) Employed to Address Fast and Slow Cook-off Thermal Threats

PREPARING ACTIVITY:	**SPONSORING ACTIVITY:**
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This document establishes specific design safety criteria for Active Hazard Mitigation Device (AHMD) intended for use with munition systems for the purpose of reducing the severity of response from such systems when subjected to Insensitive Munitions (IM) thermal threat environments.

COORDINATION DRAFT REVIEWED BY:
This document was coordinated with the following Standardization Offices: AR, AS, EA, MC, MI, MR, OS, TE, AF-2, AF-70, and AF-99. In addition, the document was also coordinated with the Joint Weapon Safety Working Group and select Subject Matter Experts (SMEs).

ASSIST COORDINATION DATE: 16 August 2014

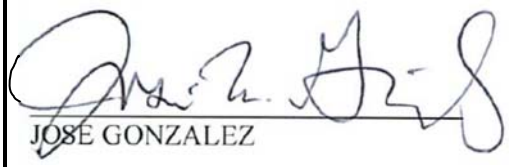
IMPLEMENTATION PLAN:

1. This document was generated due to the unique functionality requirements of Active Hazard Mitigation Device employed to mitigate IM thermal threats .

2. This document has been developed by the DOD Fuze Engineering Standardization Working Group (FESWG) for use by the Service Safety Review Authorities to assess AHMD for an acceptable level of safety for service use.

3. In all cases, the Service Safety Review Authorities will review the AHMD design and any applicable safety and risk analyses for compliance with this document.

APPROVING AUTHORITY:



JOSE GONZALEZ

12/22/14
Date

Director, Land Warfare & Munitions
Office of the Under Secretary of Defense for
Acquisition, Technology and Logistics

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DEPARTMENT OF DEFENSE
JOINT ORDNANCE TEST PROCEDURE

*Joint Ordnance Test Procedure (JOTP)-050 18 December 2014
DTIC AD No.

SAFETY DESIGN REQUIREMENTS FOR ACTIVE HAZARD MITIGATION DEVICE (AHMD) EMPLOYED TO ADDRESS FAST AND SLOW COOK-OFF THERMAL THREATS

Approved for public release; distribution unlimited.

1. SCOPE.

a. The purpose for this document is to establish specific design safety criteria for Active Hazard Mitigation Device (AHMD) intended for use with munitions for the purpose of reducing the severity of the munition's response when subjected to Insensitive Munitions (IM) thermal threat environments.

b. This document does not apply to passive hazard mitigation devices, nuclear weapon systems, and trainers.

c. This document has been developed by the Department of Defense (DOD) Fuze Engineering Standardization Working Group (FESWG) to provide safety requirements for use by the design authority. This document is also used by the Service Safety Review Authorities (SSRA) to assess the AHMD for an acceptable level of safety.

d. In all cases, the SSRA will review the AHMD design and any applicable safety and risk analyses for compliance with this document. Early coordination with the SSRA regarding the AHMD design in context with its use in a munition system is also recommended.

e. This document is applicable to new development or existing munitions that incorporate an AHMD.

2. DEFINITIONS.

a. Active Hazard Mitigation Device (AHMD). A device that generates either exothermic or explosive effects in response to specific IM thermal threat environments to reduce the severity of the munition's response to the thermal threat environments. The exothermic or explosive effects may be derived from energetic materials, a reaction of ingredients when mixed, and/or a response of normally inert materials that generate these effects in the thermal threat environments.

b. Function. Production of the output and/or effects from the AHMD.

c. IM thermal threat environments. For the purpose of this document, the following are considered IM thermal threat environments: Fast Cook-off (FCO) and Slow Cook-off (SCO). FCO and SCO tests are described in detail in Military Standard (MIL-STD)-2105.

d. Passive Hazard Mitigation Device. An inert device or integral feature of a munition and/or its packaging that is intended to reduce the severity of the munition's response to specific thermal threat environments.

3. REFERENCED AND RELATED DOCUMENTS.

a. Referenced Documents.

(1) MIL-STD-2105, Hazard Assessment Tests for Non-Nuclear Munitions.

(2) Allied Ordnance Publication (AOP)-7, Manual of Tests for the Qualification of Explosive Materials for Military Use.

(3) MIL-STD-331, Fuze and Fuze Components, Environmental and Performance Tests for.

(4) MIL-STD-1316, Fuze Design, Safety Criteria for.

(5) MIL-STD-1901, Munition Rocket and Missile Motor Ignition System Design, Safety Criteria for.

(6) Joint Ordnance Test Procedure (JOTP)-052, Guideline for Qualification of Fuzes, Safe and Arm (S&A) Devices, and Ignition Safety Devices (ISD).

(7) Standardization Agreement (STANAG) 4147, Chemical Compatibility of Ammunition Components with Explosives and Propellants (non-nuclear Applications.

(8) Allied Quality Assurance Publication (AQAP)-2110, North Atlantic Treaty Organization (NATO) Quality Assurance Requirements for Design, Development and Production.

b. Related Documents.

(1) STANAG 4170, Principles and Methodology for the Qualification of Explosive Materials for Military Use.

(2) MIL-STD-882, DOD Standard Practice - System Safety.

(3) MIL-STD-1911, Hand-Emplaced Ordnance Design, Safety Criteria for.

(Copies of these documents are available online at https://assist.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

4. REQUIREMENTS.

When an AHMD is being considered for use in munition system designs, including the logistical configuration, the following design safety requirements apply.

a. The design and implementation of the AHMD, including use of an existing AHMD on other munitions for which they have not been specifically designed, shall require review and concurrence or certification from the cognizant SSRA.

b. The AHMD shall not degrade the overall system's safety.

c. The AHMD shall not degrade safety provided by the munition's Warhead Fuzing System and/or Rocket Motor Ignition System below an acceptable level.

d. The AHMD shall be independent of the munition's Warhead Fuzing System and/or Rocket Motor Ignition System.

e. The following analyses shall be performed to identify hazardous conditions for the purpose of their elimination or control. Safety hazard analyses must consider the possibility of activation of the AHMD with and without thermal threats in all its system configurations during its lifecycle. These analyses shall be used in the preparation of system design, test, and evaluation requirements.

(1) A preliminary hazard analysis (PHA) shall be conducted to identify and classify hazards induced by credible lifecycle environments.

(2) System hazard analyses and detailed analysis, such as fault tree analyses (FTA), and failure mode, effects, and criticality analyses (FMECA), shall be conducted.

(3) Munition system level hazards associated with the function of the AHMD shall be evaluated. In addition, the hazards associated with an attempt to launch or deploy a munition containing a previously functioned AHMD shall be evaluated.

(4) Launcher system level hazards associated with the function of the AHMD post launch shall be evaluated.

f. The probability of the AHMD functioning without being subjected to thermal threats shall not exceed one in one million during all credible lifecycle environments.

g. The temperature at which the AHMD will function shall be determined for each system based on the temperature at which an unacceptable energetic reaction will occur. The selected temperature should be as high as practical to provide first responders with as much time as possible to fight fires or clear the affected area. An analysis supporting the selected temperature shall be presented to the SSRA for concurrence.

h. The AHMD shall provide a positive, direct and unambiguous indication that it has functioned.

i. Energetic materials used in the AHMD shall meet the booster explosive requirements of the U.S. Annex of AOP-7. If the energetic materials do not meet the booster explosive requirements of the U.S. Annex of AOP-7, they shall be interrupted and their inadvertent

initiation shall not lead to functioning of the AHMD. The interrupter shall adhere to the following requirements:

(1) Interrupter lock. An interrupter(s) shall be directly locked or restrained mechanically in the interrupted position by at least one safety feature. The safety feature shall be removed only when an IM thermal threat environment is sensed.

(2) Interruption position. If safety is dependent upon the presence of an interrupter, the design shall prohibit assembly in an unsafe state. A single interrupter is acceptable if the omission of the interrupter will prohibit explosive train transfer.

(3) Interruption effectiveness. The effectiveness of the interrupter shall be numerically determined in accordance with the Primary Explosive Component Safety Test of MIL-STD-331 or by similar methodologies.

j. Qualified energetic materials.

(1) Explosive materials listed in Table 1 of MIL-STD-1316 and explosive and pyrotechnic materials listed in Tables 1 and 2 of MIL-STD-1901 are approved by all services for use in a position leading to the initiation of a warhead or the ignition of a rocket or missile motor without interruption. These materials are also acceptable for use without interruption in the AHMD.

(2) The energetic material used in the AHMD shall not be altered by any means (precipitation, recrystalization, grinding, density changes, addition of materials, etc.) likely to increase its sensitivity beyond that at which the material was qualified, and at which it is customarily used, unless it is requalified.

(3) Subject to review and concurrence by the appropriate SSRA, energetic materials which do not appear in the above referenced tables may be utilized physically in-line in an AHMD if the material has been qualified and meets the U.S. Annex of AOP-7, Paragraph 10.7.16.4.1.1.b, Requirements for Booster Explosives.

k. The qualification test and analysis efforts to be conducted for the AHMD shall receive concurrence from the appropriate SSRA. JOTP-052 shall be used as a guide for appropriate test selection and quantities to be tested. In addition, testing of the AHMD shall include functioning in IM thermal threat environments to determine the minimum and maximum reaction time to assess the potential hazards to firefighters and other first responders.

l. All components used in the AHMD system shall be selected to be compatible and stable so that under all specified natural and induced environmental conditions in its life cycle, none of the following shall occur in the AHMD system prior to exposure to a thermal threat:

(1) Arming or functioning.

(2) Dangerous ejection or exudation of material.

(3) Deflagration or detonation of the explosives.

(4) The formation of dangerous or incompatible compounds. Material which could contribute to the formation of more volatile or more sensitive compounds should not be used. If such material is used, the material shall be treated, located or contained to prevent the formation of a hazardous compound (see STANAG 4147).

(5) Production of unacceptable levels of toxic or other hazardous materials.

(6) Compromise of the safety or de-arming features.

m. The AHMD shall be designed and documented to facilitate the application of effective quality control and inspection and test procedures in accordance with AQAP-2110. The design of the AHMD shall incorporate features that will facilitate the use of inspection procedures and test equipment to ensure that critical design characteristics have not been compromised. All critical design characteristics (for example: dimensions, material properties, heat treatments, and fabrication operations) shall be identified by the safety assessment and a method to ensure that these characteristics are within acceptable limits shall be incorporated during manufacturing and assembly of the AHMD.

n. All new or altered AHMD designs, new applications of existing designs, or replacement or substitution of energetic materials, or power sources, shall be presented to the appropriate service's Explosive Ordnance Disposal (EOD) research, development, test, and evaluation (RDT&E) authority for technical advice and assistance in determining viable design approaches or trade-offs towards fulfilling EOD requirements. Cognizant service EOD authorities are as follows:

(1) For Army:

Commander
U.S. Army RDECOM-ARDEC
ATTN: RDAR-MEX-P / Building 91N
Picatinny Arsenal, NJ 07806-5000

(2) For Navy and Marine Corps:

Commanding Officer
Naval Explosive Ordnance
Disposal Technology Division
Code D11
3767 Strauss Ave
Indian Head, MD 20640-5070

(3) For Air Force:

Commander
Detachment 63 ASC
2008 Stump Neck Road
Indian Head, MD 20640-5070

o. Reviewing Activity. New or altered designs or new applications of approved designs shall be presented to the appropriate SSRA for a safety evaluation and certification or concurrence of compliance with this document:

(1) Army.

Chairman
Army Weapon Systems Safety Review Board (for Joint programs),
ATTN: AMSAM-SF
Redstone Arsenal AL 35898-5301

Chairman
Army Fuze Safety Review Board
ATTN: RDAR-EIZ
Picatinny Arsenal, NJ 07806-5000

Chairman
U.S. Army Ignition System Safety Review Board
ATTN: AMSAM-SF
Redstone Arsenal, AL 35898

(2) Navy and Marine Corps.

Chairman, Weapon System Explosives Safety Review Board
Commanding Officer,
Naval Ordnance Safety and Security Activity
Farragut Hall
3817 Strauss Avenue, Suite 108
Indian Head, MD 20640-5151

(3) Air Force.

USAF Nonnuclear Munitions Safety Board
ATTN: Executive Secretary
1001 N. 2nd Street, Suite 366
Eglin Air Force Base, FL 32542-6838

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Comments, suggestions, or questions on this document should be addressed to:

Chairman, DOD Fuze Engineering Standardization Working Group, U.S. Army Armament Research, Development, and Engineering Center (RDAR-EIZ / Building 6), Picatinny Arsenal, NJ 07806-5000

and

Range Infrastructure Division (CSTE-TM), US Army Test and Evaluation Command, 2202 Aberdeen Boulevard, Aberdeen Proving Ground, Maryland 21005-5001, usarmy.apg.atec.mbx.atec-standards@mail.mil

Since contact information can change, the currency of this address information may be verified via use of the ASSIST Online database at https://assist.dla.mil. This document is identified by the accession number (AD No.) printed on the first page.